USARIEM TECHNICAL REPORT T13-##

Military Personnel Exhibit a Lower Prevalence of Obesity than the General U.S. Adult Population

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June 2013

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Natick, MA 01760-5007

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
13 JUN 2013		

4. TITLE AND SUBTITLE
Military Personnel Exhibit a Lower Presence of Obesity than the General U.S. Adult Population

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Tracey Smith ; Bernadette Marriott; Alan White; Louise Hadden; Gaston Bathalon

5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Military Nutrition Division,U.S. Army Research Institute of Environmental Medicine,Natick,MA,01760-5007

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)
11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Active-duty U.S. military personnel are not included in nationally representative health surveys. This study compared the prevalence of overweight and obesity among United States (U.S.) military personnel to comparable U.S. civilian data. This study was a retrospective, cross-sectional analysis. The prevalence of overweight [Body Mass Index (BMI) ≥25 and <30], and obesity (BMI≥30) among military personnel, using secondary data from 2002 and 2005 Department of Defense Surveys of Health Related Behaviors among Active Duty Military Personnel (2002, N=12,756; 2005, N=16,146), was compared to civilian data from the 2002 and 2005 National Health and Nutrition Examination Surveys (NHANES). Adjusted prevalence of overweight among military personnel was higher (2002: 46.2% vs. 33.3%, respectively; 2005: 45.8% vs. 31.1%, respectively, P<0.01), but obesity was lower compared to the U.S. adults (2002: 7.7% vs. 29.2%, respectively; 2005: 13.3% vs. 33.9%, respectively, P ≤ 0.01). Higher prevalence of overweight among military may include some persons having high lean body mass that is not identified through BMI estimations. Nonetheless, adjusted data suggests that overweight in both populations has declined slightly from 2002 to 2005, and that the prevalence of obesity is lower in military personnel. Future research to identify age-specific sub-trends may provide insight into targeted weight management strategies for military personnel and civilians.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**14**	

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Executive Summary

Active-duty U.S. military personnel are not included in nationally representative health surveys. This study compared the prevalence of overweight and obesity among United States (U.S.) military personnel to comparable U.S. civilian data. This study was a retrospective, cross-sectional analysis. The prevalence of overweight [Body Mass Index (BMI) ≥25 and <30], and obesity (BMI≥30) among military personnel, using secondary data from 2002 and 2005 Department of Defense Surveys of Health Related Behaviors among Active Duty Military Personnel (2002, N=12,756; 2005, N=16,146), was compared to civilian data from the 2002 and 2005 National Health and Nutrition Examination Surveys (NHANES). Adjusted prevalence of overweight among military personnel was higher (2002: 46.2% vs. 33.3%, respectively; 2005: 45.8% vs. 31.1%, respectively, P<0.01), but obesity was lower compared to the U.S. adults (2002: 7.7% vs. 29.2%, respectively; 2005: 13.3% vs. 33.9%, respectively, P ≤ 0.01). Higher prevalence of overweight among military may include some persons having high lean body mass that is not identified through BMI estimations. Nonetheless, adjusted data suggests that overweight in both populations has declined slightly from 2002 to 2005, and that the prevalence of obesity is lower in military personnel. Future research to identify age-specific sub-trends may provide insight into targeted weight management strategies for military personnel and civilians.

INTRODUCTION

The prevalence of overweight and obesity within the general U.S. adult population is of interest to the Department of Defense (DoD), since the military recruits its members from this populace[1-3]. In the U.S., national civilian prevalence of overweight (body mass index (BMI) 25 kg/m^2 -29.9 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) (4) doubled among adults between 1980 and 2004[5; 6]. The Centers for Disease Control and Prevention (CDC) reported that the age-adjusted prevalence of obesity among U.S. adults was 33.8% based on 2007-2008 National Health and Nutrition Examination Survey (NHANES) data[7], far exceeding the *Healthy People 2010* target for the nation of 15%[8]. However, U.S. national health surveillance data from 2003-2008 and 2009-2010 indicated that the prevalence of obesity in the U.S. appears to have stabilized[7; 9].

U.S. military personnel are not included in civilian datasets, and little is known about how the military prevalence of overweight and obesity compares to that of the general U.S. adult population. Regular exercise among military personnel, along with expectations to remain physically fit, may keep personnel from becoming overweight and obese, leading to a lower prevalence of health conditions typically associated with high BMI compared to the civilian population (e.g., essential hypertension, hypercholesterolemia, hyperlipidemia, type 2 diabetes mellitus (T2DM), and dysmetabolic syndrome X)[10-15]. However, between 2002 and 2005 the combined prevalence of overweight and obesity (defined as BMI ≥ 25 kg/m^2) among active duty military personnel in the Army, Navy, Air Force, and Marines increased from 57.2% to 60.5%, and obesity increased from 8.7% to 12.9%[16]. Thus, overweight and obesity may affect the general U.S. adult population and the U.S. military population alike.

The primary purpose of this study was to compare the prevalence of underweight, overweight, and obesity in military personnel with the general U.S. adult population using data amassed during a health behaviors survey that employed a complex stratified sample of active duty U.S. military personnel (i.e., Army, Navy, Air Force and Marines) and age-adjusted data from NHANES, respectively. An accurate comparison of body weight distribution between U.S. civilians and military personnel will impart a better understanding into the weight management needs of military personnel

and may assist in targeting weight management strategies for both military personnel and civilians.

METHODS

Secondary data were obtained from the 2002 and 2005 Department of Defense Survey of Health related Behaviors among Active Duty Military Personnel (HRBS) conducted by RTI International[16; 17]. The survey was administered on-site by RTI project staff at participating installations in group sessions. Respondents anonymously and voluntarily, answered the survey (average completion time was approximately 55 minutes).

Under a data use agreement, a de-identified public use file was provided by the surveys' sponsor, TriCare Management Activity (TMA). The original HRBS were approved by the Surgeon General of the U.S. Army Human Subjects in Research Protection Office (Fort Detrick), and the RTI Institutional Review Board. This secondary analysis was approved by Institutional Review Boards at the U.S. Army Research Institute of Environmental Medicine, and Abt Associates Inc.

The target populations for the survey included all active duty personnel at the time of survey distribution. Recruits, Service academy students, individuals absent without official leave, incarcerated individuals, and persons whose duty station had been changed, were excluded from the survey. After the survey, updated data on military personnel were obtained and observed eligibility rates were applied to these new personnel counts for the sampling strata defined by the intersection of Service, region, gender, and pay grade groups. Adjustment factors were calculated and applied to the weights to correct for differences in the proportion responding in the sample relative to the proportion in the population. We used the adjusted sampling weights in the statistical analyses presented here. Sample design, data collection, and weighting are further detailed in the HRBS final reports[16; 17].

BMI, defined as weight in kilograms divided by squared height in meters, rounded to the nearest tenth, was calculated using respondents' self-reported height (in feet and inches) and weight (in pounds) without shoes. Standard definitions of BMI were used to classify weight status of respondents as underweight (<18.5), healthy weight (≥ 18.5 – 24.9), overweight (25.0-29.9), or obese (≥30)[4]. Gender, age, and race/ethnicity

were included in the statistical analysis, and participants were grouped after the study into “White/non-Hispanic”, “Black or African American/non-Hispanic”, “Hispanic or Latino”, and “other” based on their combined responses to the two race/ethnicity questions[18].

The data were analyzed using SAS (Statistical Analysis Software) software release 9.1[19]. The NHANES data for 2002 and 2005 were collected based on the U.S. 2000 census; and, the BMI approach described above was used to categorize respondents as underweight, healthy weight, overweight, or obese. To compare the prevalence of BMI between military and civilians, the DoD survey data were adjusted to the 2000 U.S. census data by weighting for gender, age, and race/ethnicity. The NHANES analysis was further restricted to ages 17 to 63 to match the DoD data. T-tests were used to assess differences in adjusted prevalence of obesity reflected in the two NHANES and two DoD surveys. $P \leq 0.05$ was the acceptable significance level.

RESULTS AND DISCUSSION

The prevalence of each of the four BMI categories for military personnel and the general U.S. population, based on the 2001-2002 and 2005-2006 NHANES and the 2002 and 2005 HRBS surveys, are shown in ***Table 1***. The estimated prevalence of underweight individuals was significantly higher among the general U.S. population in both time periods than among military personnel ($P \leq 0.01$). However, the prevalence of overweight was significantly higher ($P \leq 0.001$) among military personnel than in the general U.S. population for both time periods. The prevalence of obesity was significantly lower in military personnel for both surveys than the general U.S. population estimates for the same time periods ($P \leq 0.001$). For both groups, the obesity prevalence was higher in 2005 compared to 2002 [military personnel, 2002: 7.7%; 2005: 13.3%; civilian, 2002: 29.3%; 2005: 33.9% ($P \leq 0.001$)]. Overweight appears to have stabilized in both military and civilian populations with no statistically significant differences in prevalence between the two time periods in either group.

Active duty military personnel are not included in the U.S. CDC national surveys [e.g., NHANES, Behavioral Risk Factor Surveillance System (BRFSS), and National Household Interview Survey (NHIS)]. BMI results among military personnel were compared to the general U.S. population using similar time points for data collected in

the NHANES, by adjusting the military data to the U.S. Census on which NHANES sampling frames were based. The prevalence of overweight and obesity presented herein for the NHANES data is much lower than previously reported[6; 20-22] because the current data are adjusted to the U.S. Census for 2000, and represent an age-based subset of the national data. This comparison found fewer underweight and obese individuals among military personnel compared to the general U.S. adult population at both the 2002 and 2005 time points; while relatively more military personnel were within the range of normal weight (BMI ≥ 18.0 to < 25.0) and overweight (BMI ≥ 25.0 < 30.0) compared to the general U.S. population.

The military Services long have used weight and body fat standards and fitness requirements to monitor excess body fat and maintaining fitness levels among personnel. Personnel are screened semi-annually using gender-specific weight-for-height Service-specific tables[23-25]. Personnel whose weight does not meet the standards undergo specific anthropometric measurements to determine the percent of their body mass comprised of fat. Those personnel whose body fat exceeds the standards are required to participate in programs aimed at reducing body weight and body fat[26]. Those who consistently fail to meet body fat standards are subject to discharge from the military. Although the prevalence of obesity among military personnel is lower than that of the general U.S. population, the prevalence of overweight in this study among military personnel is still high. This prevalence estimate may be somewhat overstated due to incorrect BMI classification of some physically fit military personnel having a large lean body mass[4; 27].

Military personnel may be somewhat protected from obesity due to their physically active lifestyle[16] and the fact that they must meet service-specific fitness requirements[23; 25; 28; 29]. For example, our analysis of the 2005 HRBS indicated that ~58% of military personnel engaged in moderate or vigorous intensity leisure time physical activity ≥ 30 minutes/day ≥ 5 days/week or ≥ 20 minutes/day ≥ 3 days/week, respectively (unpublished data). In contrast, only 32% of the general U.S. population met these goals for moderate or vigorous physical activity[30]. These differences in leisure time physical activity could partially explain why obesity prevalence is lower in military personnel versus the general U.S. population.

A limitation or our analysis is its use of cross-sectional data, which does not permit comparison of the same cohort over time. Another potential limitation is that the height and weight data for the Military cohort are self-reported, whereas the NHANES height and weight data were measured. A validity study using NHANES III data concluded that self-reported height and weight data did not differ significantly from measured data for younger adults[31]. This, combined with the fact that most military personnel monitor their body weight more closely than the general U.S. populace[26], reduces the potential for self-reported weight bias in the current study.

CONCLUSION

This study describes the body weight distribution between U.S. civilians and military personnel which imparts a better understanding into the health needs of military personnel and provides insight into further research to assist in targeting weight management strategies for both military personnel and civilians. Similar to the general U.S. population, the active duty military also are faced with a continuing problem of overweight and obesity. This situation is compounded by the high prevalence of overweight and obesity among the civilian population from which the military recruit their personnel[1-3]. Recent data based on NHANES for the full civilian population documented a relative stabilization in obesity prevalence from 2003-2004 to 2007-2008. In this comparative analysis based on an adjusted subset that comprised a more limited adult age range, obesity was higher in the later survey year for both civilians (NHANES) and military (HRBS). However, while BMI-based prevalence estimates of overweight among military personnel were higher than analogous civilian estimates, both populations demonstrated stability in overweight prevalence between the time periods. These data suggest that, at least in this adjusted data for these two time periods, trends in BMI-based body weight estimates merit further evaluation for distinctive sub-trends among different age groups. Such analysis may identify distinctive patterns that may aide in targeting weight management strategies for military personnel and civilians. The physically active lifestyle of military personnel, and the service-specific fitness and annual measurement requirements, may have a protective effect against obesity.

DISCLAIMERS & FUNDING DISCLOSURES

The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or reflecting the views of the Army, Department of Defense or TMA. Any citations of commercial organizations and trade names in this report do not constitute an official Department of the Army endorsement of approval of the products or Services of these organizations. The analysis reported in this paper was supported in full by U.S. Army Contract # W911QY-09-P-0082 with Abt Associates Inc., and a sub-contract from Abt Associates Inc. to the Samueli Institute.

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Table 1. Prevalence (± SE) of Military and Civilian Body Mass Index (BMI) with Military[a] and NHANES Adjusted[b] to U.S. Census by Age, Gender and Race: 2002 and 2005

BMI (kg/m^2)	DOD 2002 (adjusted to Census 2000)	DOD 2005 (adjusted to Census 2000)	NHANES 2001-2002	NHANES 2005-2006
Sample (Estimated Population)	11,792 (1,050,321)	15,195 (949,783)	4,408 (165,104,857)	4,364 (174,905,447)
< 18.5	1.1±0.20[c,d**]	1.4±0.16[c,e*]	2.1±0.26[d**,f]	2.2±0.37[e*,f]
18.5- 24.9	45.1±1.38[c**,d**]	39.6±1.13[c**,e**]	35.3±0.77[d**,f]	32.9±1.56[e**,f]
25.0-29.9	46.2±0.96[c,d**]	45.8±1.10[c,e**]	33.3±1.19[d**,f]	31.0±0.92[e**,f]
>30.0	7.7±0.51[c**,d**]	13.3±0.42[c**,e**]	29.3±1.09[d**,f**]	33.9±1.82[e**,f**]

BMI, body mass index

[a]The data for the DoD 2002 Health Related Behaviors Survey Among Active Duty Military Personnel was collected from September 2002 through mid-February 2003; the data for the DoD 2005 Health Behaviors Survey Among Active Duty Military Personnel was collected from April through August, 2005. BMI prevalence may differ from previous publications[16, 17] because Army warrant officers were included in these analyses.

[b] NHANES data was adjusted by weighting to the 2000 U.S. census for Hispanic, age, and gender and restricted to ages 17 through 63 for the analysis.

[c-f] Values with the same superscript letter significantly differed from one another. *P<0.01 **P<0.001)